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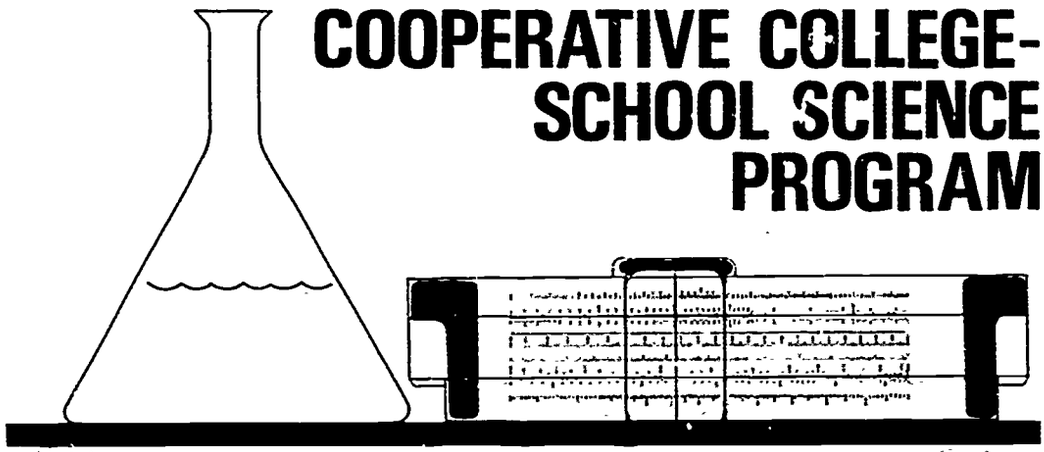
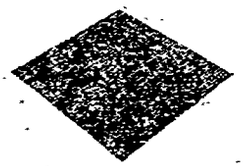
ABSTRACT

This directory discusses the purpose, organization, and funding of Cooperative College-Science projects. Brief descriptions of the 81 projects for 1973-74 are given; information on location, time, number and level of teachers attending, purpose, and director are provided for each project. (DT)

COOPERATIVE COLLEGE-SCHOOL SCIENCE PROGRAM





JOINT EFFORTS OF SCHOOL SYSTEMS AND COLLEGES TO IMPROVE SCIENCE AND MATHEMATICS IN THE SCHOOLS

1973 DIRECTORY

E-73-P-23

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

The Cooperative College-School Science Program

FOR SCHOOL SYSTEM IMPROVEMENT

The National Science Foundation through the Cooperative College-School Science Program (CCSS) provides opportunities for colleges, universities, and similar institutions to work with school systems in improving elementary and secondary school science and mathematics programs. Projects supported through CCSS are addressed to practical problems of the school science or mathematics program which are of sufficient substance and complexity to warrant a cooperative approach by the schools and a nearby college.

Many of the projects in CCSS have as their purpose the introduction into school classrooms of one of the science or mathematics instructional programs which have been developed in recent years by teams of scientists and educators. These programs have opened new and dramatic possibilities for science and mathematics teaching and many schools now wish to make use of them.

A decision on the part of a school system to adopt a new science or mathematics program implies many commitments. New books, equipment and supplies, even new laboratory facilities, may have to be provided. Adaptation of materials to local needs may be desirable. Most importantly, instruction must be provided for the teachers who will implement the use of the materials. A grant from the CCSS Program may enable a college or university to provide much of the expert assistance in implementation which is required. As an approach, the system may arrange for a group of its teachers to participate in a summer instructional program jointly planned by the college and the school system. This is normally followed during the next academic year by further in-service teacher training, school classroom visits by college personnel, informational meetings for school administrators, etc. Grants are made primarily for the purpose of introducing desired developments into school systems, rather than for planning. Major planning activities between the schools and the cooperating college have already occurred in advance of a proposal being submitted to the Program.

Not all of the projects supported through the CCSS Program are to introduce school system changes as comprehensive as a new science curriculum. In some cases, existing courses may need to be modernized and enriched as part of a revitalization of the science or mathematics program. Again, a college may assist by working with the school system to provide relevant instruction and intellectual support for school system personnel.

The impetus for a project may come from the schools, sensitive to their own requirements and anxious to begin some reform. In other cases, the college may take

the lead in introducing school system administrators and teachers to the possibility of implementing an improved science or mathematics offering through a CCSS grant.

Whatever its genesis, a CCSS Project is a program of *implementation* and is designed to effect a specified change in designated classrooms. Consequently, a project will almost certainly involve the training of selected school system personnel in the use of materials and strategies to accomplish this change. Those projects which are most successful usually have a commitment on the part of the school district to a comprehensive in-service training program during the ensuing academic year which utilizes the expertise of the participants and project staff to accomplish a "multiplier effect" throughout the district.

A project may involve a continuing relationship between college and schools extending over a period of a few years until desired changes are accomplished, but support through CCSS should have a planned phasing out within a reasonable time.

Normally grants are made in the CCSS Program only to colleges, univeristies, and similar institutions although schools are involved in the planning. Because these projects are designed to assist specific schools, teacher-participants are selected from these schools. Teachers seeking information should therefore communicate with the individual project directors, not with the National Science Foundation. The programs receive adequate publicity within the school systems to which they apply.

Teachers who receive training in these projects during several weeks in the summer may receive stipends and dependency allowances through the Foundation grant. For academic year activities, the grant may also provide funds to assist with transportation and meal costs. As partners in the enterprise, the schools are encouraged to participate in the financial support of a project. This support is usually in the form of providing (1) funds for purchase of materials, (2) released time for participants, and other school personnel, and/or (3) facilities for meetings, seminars, and classroom activities. The grantee institution is responsible for proposing cost-sharing arrangements for participant support when possible.

CCSS projects assist the schools to provide better instructional programs for specific groups of students. Some attempt to promote the development in science of students who are already well motivated and capable; others are designed to increase the relevance and meaning of science and mathematics for students who are socially or educationally disadvantaged. The mechanism of the CCSS Program which uses, in tandem, capabilities of the schools and the resources of the colleges can contribute fresh approaches for educating the disadvantaged; however, funds are limited, and only model or pilot projects are supported. In particular, support for the training of large groups of students is not within the purview of CCSS. Successful projects should aim at school system changes which will operate to achieve the desired goals.

In its fiscal year 1973 support for CCSS projects, the Foundation awarded 81 grants totaling $2,376,256 to higher educational institutions. Through these grants, training opportunities for approximately 4,200 teachers will be made available. Over one-half of the projects focus on elementary schools and the remainder on junior or senior high schools. A few of the projects provide for the use of special student-demonstration classes. Brief descriptions of the 81 Cooperative College-School Science projects are appended.

Inquiries concerning the CCSS Program should be addressed to:

Cooperative College-School Science Program
Division of Pre-College Education in Science
National Science Foundation
Washington, D.C. 20550

Cooperative College-School Science Projects 1973-74

ALABAMA

FLORENCE STATE UNIVERSITY, Florence 35630; *Elementary School Science* (Science Curriculum Improvement Study materials); summer: 2 weeks, July 30—August 10, 1973; academic year 1973-74: 10 meetings; 18 elementary school teachers, two junior-senior high school science teachers and 3 school administrators from Cullman City School System will receive instruction in SCIS materials and be prepared to implement the curriculum in grades 4, 5, and 6 of their system. Mr. Hollis C. Fenn, Department of Science.

ARIZONA

ARIZONA STATE UNIVERSITY, Tempe 85281; *Elementary School Science* (Science Curriculum Improvement Study materials); summer: 5 weeks, June 4—July 6, 1973; academic year 1973-74: 9 meetings; 44 elementary teachers and 6 administrators from Mesa Public Schools and the Washington Elementary School District. Teachers and administrators will receive training in SCIS materials and will teach the program and serve as resource teachers in the 1973-74 academic year in their schools. Dr. Frederick A. Staley, School of Education.

See also Colorado: **FORT LEWIS COLLEGE,** in cooperation with Bureau of Indian Affairs Schools in Northern Arizona.

CALIFORNIA

CALIFORNIA STATE UNIVERSITY, FULLERTON, Fullerton 92634; *Elementary School Science* (Science Curriculum Improvement Study materials); summer: 4 weeks, July 2—July 27, 1973; academic year 1973-74: 18 meetings; 70 elementary school teachers from Capistrano Unified School District and Santa Ana Unified School District. Teachers will be trained in the philosophy and content of the SCIS materials and be prepared to implement the program in their classrooms during the academic year. Dr. Francis P. Collea, Department of Science and Mathematics Education.

CALIFORNIA STATE UNIVERSITY, NORTHRIDGE, Northridge 91324; *Elementary School Social Science* (Man: A course of Study materials); summer: 4 weeks, June 25—July 20, 1973; academic year 1973-74: 20 meetings; 75 elementary school teachers and administrators from the Los Angeles Unified School District, the Saugus Union School District, and the Las Virgenes Unified School District. During the summer phase, school district personnel will be provided intensive inservice education on the nature and use of MACOS materials, and follow-up training will be given during the academic year while they are using the materials in their classrooms. Twenty teachers will receive special leadership training to assist with the implementation of these materials in their school districts. Dr. Helen Fielstra, School of Education.

CALIFORNIA STATE UNIVERSITY, SAN JOSE, San Jose 95192; *Marine Science for Elementary and Secondary Schools* (Curriculum and Techniques); summer: 3 weeks, August 13—August 31, 1973, to be held at Marine Ecological Institute, Redwood City; academic year 1973-74: 12 meetings; 40 elementary and secondary school science teachers from 11 San Francisco Bay Area school districts located in Santa Clara, San Mateo, Alameda, and Marin Counties. Teachers will be instructed in the marine sciences, conduct marine science studies aboard a research vessel, and be trained in the use of marine science curriculum materials for implementation into the classroom. Dr. Robert L. Hassur, Department of Natural Sciences.

UNIVERSITY OF CALIFORNIA, DAVIS, Davis 95616; *Elementary School Science* (Science Curriculum Improvement Study and Elementary Science Study materials); summer: 2 weeks, June 25—July 9, 1973; academic year 1973-74: 16 meetings; 20 elementary teachers and 2 elementary administrators from the Woodland Joint Unified School District. Teachers and principals will receive instruction in SCIS and ESS and be prepared to implement these curriculums in their classrooms as well as train the additional primary teachers of the District. Dr. Victor A. Perkes, Department of Science Education.

UNITED STATES INTERNATIONAL UNIVERSITY, San Diego 92124. *Junior High School Science* (Intermediate Science Curriculum Study materials); summer: 6 weeks, June 18—July 27, 1973; academic year 1973-74: 16 meetings; 30 junior high school teachers and 60 students (for demonstration classes) from schools in San Diego Unified School District. Teachers will receive training in ISCS materials and will teach the program during the academic year in their classrooms. They will also conduct in-service training for teachers in their school buildings. Dr. Harry N. Barnet, Department of Chemistry and Natural Science.

COLORADO

FORT LEWIS COLLEGE, Durango 81301; *Elementary Mathematics;* summer: 5 weeks, June 4—July 6, 1973; academic year 1973-74: 39 meetings; 25 elementary school teachers and 5 teacher's aides from Navajo Area Bureau of Indian Affairs elementary schools in the Chinle, Eastern Navajo, Fort Defiance, Shiprock and Tuba City agencies. Teachers and aides will revise the mathematics curriculum and prepare materials, using a concept-development approach, for implementation during the 1973-74 academic year. Dr. Richard A. Gibbs, Department of Mathematics.

UNIVERSITY OF COLORADO, COLORADO SPRINGS CAMPUS, Colorado Springs 80907; *Elementary School Science* (Science Curriculum Improvement Study materials); summer: 2 weeks, June 11—June 22, 1973; academic year 1973-74: 22 meetings; 46 elementary teachers, 4 administrators and/or coordinators, and 60 students (for microteaching and demonstration lessons) from Widefield—Security School District No. 3. Teachers and administrators will receive instruction in SCIS materials and implement the program in their classrooms during the academic year. Dr. Jack E. Sherman, Department of Science Education.

CONNECTICUT

EASTERN CONNECTICUT STATE COLLEGE, Willimantic 06226; *Junior-High School Science* (Intermediate Science Curriculum Study materials); spring: 3 meetings, April 27—May 25, 1973; summer: 3 weeks, June 25—July 13, 1973; academic year 1973-74: 9 meetings; 20 junior high teachers from school districts of Ellington, Mansfield, Eastford, Ashford, Columbia, Montville and Norwich. Teachers will receive instruction in ISCS materials and be prepared to implement the curriculum in their schools. Dr. Ralph J. Yulo, Jr., Department of Science Education.

FAIRFIELD UNIVERSITY, Fairfield 06430; *Mathematics and Computer Science;* 6 weeks, June 25—August 3, 1973; academic year 1973-74: 8 meetings; 25 key teachers (Grades 8—12) from Darien, Fairfield, Norwalk, Stamford, Trumbull, and Weston public school systems. Teachers will receive instruction in mathematics content and the use of the computer to teach mathematics, and will implement this program in their schools during the academic year. Dr. Michael P. Zabinski, Physics Department.

FLORIDA

FLORIDA STATE UNIVERSITY, Tallahassee 32306; *Elementary School Social Science* (Social Science Laboratory Units); summer: 5 weeks, June 18—July 20, 1973; academic year 1973-74: 10 meetings; 18 middle school teachers and 2 assistant principals from Madison County Schools will receive instruction in the Social Science Laboratory Units and implement these materials in their classrooms. Dr. William Rader, Department of Social Studies Education.

GEORGIA

GEORGIA STATE UNIVERSITY, Atlanta 30303; *Mathematics;* summer: 6 weeks, June 19—July 29, 1973; academic year 1973-74: 9 meetings; 25 junior high school teachers and 30 junior high school students (for video-tape lesson development) from Atlanta Public Schools. The purpose of the project is to train teachers in contemporary mathematical content and methodology, and to explore a variety of urban mathematical materials, and to assist in implementation and follow-up during the academic year. Dr. Hiram D. Johnston, College of Education, Mathematics, and Urban Life.

LAGRANGE COLLEGE, LaGrange 30240; *Elementary School Mathematics* (The Madison Project Curriculum materials); summer: 2 weeks, July 30—August 10, 1973; academic year 1973-74: 10 meetings; 26 elementary school teachers and 4 elementary school principals from LaGrange Public Schools. Teams of teachers and their principals will be instructed in Madison Project mathematics and be prepared to implement these materials and associated concepts in their schools during the academic year 1973-74. Mr. Richard D. Jolly, Mathematics Department.

UNIVERSITY OF GEORGIA, Athens 30601; *Elementary School Science* (AAAS Science—A Process Approach materials); summer: 3 weeks, July 23—August 10, 1973; academic year 1973-74: 10 meetings; 26 elementary school teachers (Grades 1—3) and 4 administrators from the Gwinnett County School System will receive training in AAAS materials and will teach the program in their classrooms. Dr. W.R. Zeitler, Department of Science Education.

IDAHO

UNIVERSITY OF IDAHO, Moscow 83843; *Engineering* (Engineering Concepts Curriculum Project materials); summer: 6 weeks, June 11—July 20, 1973; academic year 1973-74: 4 meetings, 25 secondary school teachers and 1 principal from Idaho schools: Cascade, Culdesac, Caldwell, Dayton, Dietrich, East Minico, Grace, Kellogg, Lewiston, Minidoka, Mountain Home, Parma, Preston, Rigby, Rockland, Soda Springs, Shelley, Troy, Wallace; and from Eastern Washington School District No. 101: Spokane, Lincoln, Whitman, Stevenson, Ponderay, Ferry. Participants will receive instruction in ECCP materials and will be prepared to implement the ECCP course, "The Man-Made World", during the academic year in their schools. Professor A. L. Rigas, College of Engineering.

ILLINOIS

ILLINOIS STATE UNIVERSITY, Normal 61761; *Elementary School Science* (AAAS Science—A Process Approach materials); summer: two 3-week sessions, June 18—July 6, or July 9—July 27, 1973; academic year 1973-74: 16 meetings; 50 elementary school teachers from thirteen school districts of central Illinois. This project is designed to improve science instruction in the elementary schools of cooperating districts by training teachers in the content and methodologies of the AAAS program and assisting them in implementing this course in their classrooms. Dr. Thomas Edwards, Department of Elementary Education.

See also Indiana: **PURDUE UNIVERSITY,** in cooperation with two Illinois School Districts: Chicago Public School District No. 10 and Township High School District No. 214.

INDIANA

PURDUE UNIVERSITY, Lafayette 47907; *Interdisciplinary Science and Social Studies;* summer: 6 weeks, June 17—July 27, 1973; 24 senior high school teachers; academic year 1973-74: 10 meetings; 48 high school teachers from Gary School System, Southeastern School Corporation, Delphi Community School Corporation, North Judson Community School Corporation, Indiana; and District No. 10 of Chicago Public Schools, and Township High School District No. 214, Illinois. The participants will develop and implement individualized lessons on the social aspects of science. Professor Jane B. Kahle, Department of Biological Sciences.

PURDUE UNIVERSITY, Lafayette 47907; *Elementary School Science* (Elementary Science Study materials); summer: 4 weeks, June 4--June 29, 1973; 25 teachers and 5 administrators; academic year 1973-74: 50 meetings (2 groups, 25 meetings each); 50 teachers and 5 administrators from the Lafayette School Corporation. Participants will implement ESS curriculum in their schools and will serve as models for the successful implementation of a new elementary school science curriculum. Dr. Gerald H. Krockover, Education Department.

IOWA

DRAKE UNIVERSITY, Des Moines 50310; *Elementary School Science* (AAAS Science—A Process Approach materials); summer: 4 weeks, June 4—June 29, 1973 for teachers; 1 week, June 25—June 29, 1973 for principals; academic year 1973-74: 7 meetings; 29 teachers and 27 principals from Ankeny, Colfax, Des Moines Independent, Newton, and Southeast Polk Community School Districts in central Iowa. Selected teachers will be trained as resource teachers and as leaders for in-service programs to implement the AAAS course into the schools. Elementary school principals will receive training in AAAS materials and will develop techniques to support the teachers in the use of these materials. Dr. Paul H. Joslin, College of Education.

IOWA STATE UNIVERSITY, Ames 50010; *Environmental Science;* summer: 3 weeks, July 16—August 3, 1973; academic year 1973-74: 8 meetings; 25 elementary school teachers from Ames Community School District. Teachers will receive training in Environmental Science and associated strategies of teaching and will assist peers to implement Program during the academic year. Dr. Lynn W. Glass, College of Education.

UNIVERSITY OF NORTHERN IOWA, Cedar Falls 50613; *Physics* (Project Physics materials); summer: 6 weeks, June 11—July 20, 1973; academic year 1973-74: 7 Saturday meetings on coordination and implementation of Project Physics materials for 24 participating physics teachers in the southwest quadrant of Iowa. The main purpose is to vitalize the physics curriculum by initiating and implementing Project Physics in cooperating school systems. Dr. Roy Unruh, Department of Physics.

KANSAS

KANSAS STATE COLLEGE, Pittsburg 66762; *Elementary School Mathematics;* summer: 6 weeks, June 18—July 27, 1973; academic year 1973 74: 7 meetings; 40 elementary classroom teachers from Miami Public Schools, Oklahoma, and Neosho Public Schools, Missouri. The purpose of this project is to train teachers in the content and methodology of contemporary mathematics, and to assist in the inservice training of all elementary teachers from the participating school districts. Dr. Forrest L. Coltharp, Mathematics Department.

KANSAS STATE UNIVERSITY, Manhattan 66502; *Elementary School Science and Mathematics* (AAAS Science—A Process Approach and Nuffield Mathematics materials); summer: 4 weeks, July 16—August 10, 1973; academic year 1973-74: 5 meetings; 40 elementary school teachers (Grades K-3) from the Shawnee Mission School District No. 512. Teachers will receive instruction in the content, philosophy and rationale of the AAAS and Nuffield Mathematics programs in order to prepare and teach integrated lessons in their schools. Dr. Ray Kurtz, Department of Curriculum and Instruction.

WICHITA STATE UNIVERSITY, Wichita 67208; *Secondary School Mathematics* (Colorado Schools Computing Science Curriculum Development Project materials); summer: 3 weeks, July 30—August 17, 1973: 10 meetings; 24 high school teachers from Wichita School District No. 259. Teachers will receive training in the Colorado Schools Computing Science Curriculum Development Project and will teach the program during the 1973-74 and/or 1974-75 academic year. Dr. Michael P. Tilford, Department of Secondary Education.

KENTUCKY

UNIVERSITY OF LOUISVILLE, Louisville 40208; *Secondary School Mathematics* (Computer in Mathematics Teaching); summer: 6 weeks, July 2—August 10, 1973; academic year 1973-74: 16 meetings; 32 secondary school teachers from schools of Louisville and Jefferson County. Teachers will take two courses and gain experience in the use of the computer to teach mathematics, and implement this in their schools during the academic year. Dr. Roger H. Geeslin, Department of Mathematics.

WESTERN KENTUCKY UNIVERSITY, Bowling Green 42101; *Mathematics* (University of Illinois Committee on School Mathematics materials); summer: 4 weeks, June 11—July 6, 1973; academic year 1973-74: 4 meetings at the University and 6 sessions at each of 3 regional training sites; 30 junior high school teachers from schools of Breckinridge, Christian, Daviess, and Jefferson County systems, and Bowling Green City system. Teachers will receive training in *Stretchers and Shrinkers and Motion Geometry* materials in a summer workshop, and will implement the materials in selected schools during the academic year. Dr. Richard J. DeMars, Department of Secondary Education.

LOUISIANA

LOUISIANA STATE UNIVERSITY IN NEW ORLEANS, New Orleans 70122; *Elementary School Science* (Elementary Science Study materials); summer: 1 week, August 20-24, 1973; academic year, fall 1973: 18 meetings; 24 elementary school teachers, grades 3-6, from 3 elementary schools in Orleans Parish Public Schools; academic year, spring 1974: 36 meetings; 48 University science methods students. Teachers and University students will receive instruction in ESS materials and will cooperatively implement the curriculum in the participating schools. Dr. Paul C. Beisenherz, College of Education.

NICHOLLS STATE UNIVERSITY, Thibodaux 70301; *Earth Science* (Earth Science Curriculum Project materials); summer: 6 weeks, June 11—July 20, 1973; academic year 1973-74: 6 meetings; 24 junior high school teachers from the parishes of Iberville, Jefferson, Orleans, St. Bernard, and Terrebonne. Teachers will receive training in ESCP materials and will implement the program during the academic year in their classrooms. Dr. J. B. Sachs, Department of Earth Science.

MAINE

UNIVERSITY OF MAINE AT FARMINGTON, Farmington 04938; *Elementary School Science* (Elementary Science Study materials); summer: 4 weeks, July 2—July 27, 1973; academic year 1973-74: 10 meetings; 32 elementary teachers and 8 administrators from Maine School Administrative Districts No. 3, 43, and 74. Teachers and administrators will receive instruction in ESS materials and be prepared to implement the curriculum in their schools. Dr. Stephen F. Godomsky, Education Department.

MASSACHUSETTS

WESTFIELD STATE COLLEGE, Westfield 01085; *Elementary School Science* (Elementary Science Study and Environmental Education materials); summer: 3 weeks, August 6—August 24, 1973; academic year 1973-74: 4 meetings; 60 elementary school teachers and 10 elementary school administrators from the Springfield, Longmeadow, Wilbraham, and South Hadley Public School Systems. Teachers and administrators will receive instruction in ESS materials and ecology, in preparation for integrating these in the curriculum of their schools. Professor J. Kenneth Taylor, Department of Biology.

MICHIGAN

MICHIGAN STATE UNIVERSITY, East Lansing 48823; *Elementary School Science* (AAAS Science—A Process Approach materials); summer: 3 weeks, August 6—August 24, 1973; academic year 1973-74: 5 two-day sessions; 40 elementary teachers from Traverse City Area School District. Teachers will receive training in the use of AAAS materials and will teach the program in their classrooms during the 1973-74 academic year. Dr. Bruce Cheney, Science and Mathematics Teaching Center.

WAYNE STATE UNIVERSITY, Detroit 48202; *Elementary School Science* (AAAS Science—A Process Approach materials); summer: 3 weeks, August 6-August 24, 1973; academic year 1973-74: 40 meetings plus 25 days consultant services; 61 elementary school teachers from Highland Park School District, Lincoln Park Public Schools, and Wayne-Westland Community Schools. Teachers will receive instruction in AAAS materials and be helped to assume leadership roles in implementing science instruction in their respective schools. Dr. Frank O. Youkstetter, Department of Science Education.

MISSISSIPPI

ALCORN A.&M. COLLEGE, Lorman 39096; *Elementary School Science* (Science Curriculum Improvement Study materials); summer: 4 weeks, July 16—August 10, 1973; academic year 1973-74: 4 seminars and 6 on-site visits; 30 elementary school teachers of the Natchez Special Municipal Separate School District will be trained in selected scientific concepts and teaching methods, prior to introducing the SCIS program in their classrooms during the academic year. Dr. Norris Allen Edney, Department of Biology.

DELTA STATE COLLEGE, Cleveland 38732; *Mathematics;* summer: 5 weeks, June 4—July 6, 1973; academic year 1973-74: 4 meetings; 30 teachers of mathematics in the middle grades from Vicksburg Municipal Separate School District, and Warren County School District. Teachers will receive training in methods and techniques for teaching low achievers in the middle grades (grades 4-9), and they will construct multisensory devices for use in their classroom during the school year 1973-74. Dr. Daisy Howell, Department of Mathematics.

MISSISSIPPI VALLEY STATE COLLEGE, Itta Bena 38941; *Biology* (Biological Sciences Curriculum Study, Green Version materials); summer: 6 weeks, June 25—August 3, 1973; academic year 1973-74: 20 meetings; 10 junior high school and 20 senior high school biology teachers from Leflore, Sunflower and Humphreys County school systems. The participants will be trained to teach the Green Version BSCS materials by using the outdoor environment near the schools as field laboratories. Dr. Satnam L. Sethi, Department of Science and Mathematics.

UNIVERSITY OF SOUTHERN MISSISSIPPI, Hattiesburg 39401; *Elementary School Science* (Science Curriculum Improvement Study and AAAS Science—A Process Approach materials); summer: 3 weeks, June 4—June 21, 1973; academic year 1973-74: 10 meetings; 70 elementary school teachers and administrators from Choctaw agency, Bureau of Indian Affairs; Enterprise Consolidated School District, Lamar County School System, Lauderdale County School System, Laurel City Schools, Lawrence County School System, Newton County School System, and Quitman Consolidated School District. Teachers and administrators will receive instructions in SCIS or AAAS materials and be prepared to implement one of these curricula in their schools. Dr. Bobby E. Craven, Department of Science Education.

MISSOURI

NORTHWEST MISSOURI STATE UNIVERSITY, Maryville 64468; *Mathematics School Leadership Program* (Development of local teacher-leaders in mathematics K-12); summer: 2 weeks, June 18—June 29, 1973; academic year 1973-74: 8 meetings; 45 teacher-leaders from school districts in northwest Missouri. Teachers will receive continued training in the nature of K-12 mathematics, leadership techniques and strategies for school program improvement, and examples of strategies for incorporating segments of applied mathematics in the school mathematics program. Dr. Morton R. Kenner, Department of Mathematics.

See also Kansas: **KANSAS STATE COLLEGE,** in cooperation with Neosho Public Schools.

MONTANA

NORTHERN MONTANA COLLEGE, Havre 59501 (in cooperation with the University of Montana, Eastern Montana College, and the Office of the Superintendent of Public Instruction); *Elementary School Science* (Science Curriculum Improvement Study and Elementary Science Study materials); summer: 3 weeks, July 23—August 10, 1973; academic year 1973-74: 35 meetings; 75 elementary school teachers from Hardin, Lodge Grass, Wyola, Lame Deer, Harlem, Hays-Lodge Pole, Box Elder, Rocky Boy, Poplar, Brockton, Babb, Cut Bank, Heart Butte, Browning, Charlo, Arlee, St. Ignatius, East Glacier, Elmo and Frazer schools serving the Blackfeet, Flathead, Rocky Boy, Fort Peek, Fort Belkap, Crow, and Northern Cheyenne Reservations. Teachers will receive training in SCIS and/or ESS materials and will teach these programs during the academic year in their classrooms. Dr. C. Everett Pitt, Department of Science.

NEBRASKA

KEARNEY STATE COLLEGE, Kearney 68847; *Elementary School Science* (Elementary Science Study materials); summer: 3 weeks, June 4—June 22, 1973; academic year 1973-74: 14 meetings; 25 elementary school teachers, 3 principals, 2 secondary science teachers from the Grand Island School District. Teachers will receive training in ESS materials and will teach units from the program during the academic year in their classrooms. Dr. Roger L. Carlson, Department of Physical Science.

UNIVERSITY OF NEBRASKA, Lincoln 68508; *Elementary School Science* (AAAS Science—A Process Approach materials); summer: 2 weeks, July 16—July 27, 1973; academic year 1973-74: 6 meetings for 40 participating elementary school teachers, 3 of which will include 40 elementary school teachers-in-training from the Lincoln Public School System. Teachers will receive training in environmental science and AAAS materials and will teach the program during the academic year in their classrooms. Dr. Ward Sims, Educational Director, Elementary Education Department.

NEW HAMPSHIRE

PLYMOUTH STATE COLLEGE, Plymouth 03264; *Elementary School Science* (Elementary Science Study materials); academic year 1973-74: 30 weekly meetings; 55 elementary school teachers and supervisors of instruction from New Hampshire Supervisory Union No. 3 (Berlin). Teachers will receive instruction in selected topics in science and teaching methods related to the ESS materials and implement the program in their classrooms. Dr. Mark T. Sylvestre, Department of Natural Science.

NEW JERSEY

TRENTON STATE COLLEGE, Trenton 08625; *Elementary and Junior High School Social Science* (Social Sciences: Concepts and Values and Man: A Course of Study materials); summer: 4 weeks, July 2—July 27, 1973; academic year 1973-74: 20 meetings; 68 elementary school teachers, 10 elementary school principals, 10 junior high school teachers, and 2 junior high school principals from the Willingboro Public Schools. Teachers and principals will receive instruction in the Social Sciences: Concepts and Values and MACOS materials and be prepared to implement the curriculums in their schools. Dr. John W. Shea, Jr., Early Childhood and Elementary Education Department.

NEW MEXICO

NEW MEXICO STATE UNIVERSITY, Las Cruces 88001; *Computer Science*; summer: 5 weeks, June 4—July 6, 1973 with follow-up academic year program in the schools; 42 junior and senior high school teachers from Gadsden Independent Schools, Hatch Valley Municipal Schools, Alamogordo Public Schools, Deming Public Schools, and Las Cruces Public Schools. The project is designed to make computer facilities available to high schools in the area and to develop teachers with the expertise to integrate computer problem-solving techniques and philosophy into the science and mathematics curriculum. Dr. Frank Carden, Department of Electrical Engineering.

See also Colorado: **FORT LEWIS COLLEGE,** in cooperation with Bureau of Indian Affairs Schools in Northern New Mexico.

NEW YORK

CITY UNIVERSITY OF NEW YORK, RICHMOND COLLEGE, Staten Island 10301; *Physical Science* (Introductory Physical Science materials); summer: 3 weeks, August 13—August 31, 1973; academic year 1973-74: 12 meetings; 30 teachers from high schools in Manhattan, Bronx, Queens, Brooklyn, and Richmond of the New York City Public School System. Teachers will receive training in the physical sciences enabling the implementation of the IPS program. Dr. Gerard O. Solomon, Division of Professional Studies.

HOFSTRA UNIVERSITY, Hempstead 11550; *Elementary School Science* (Science Curriculum Improvement Study materials); academic year 1973-74: 30 meetings; 66 elementary school teachers, from schools of the Herricks, New Hyde Park, Elmont, Franklin Square and Wantagh School Districts, Nassau County, Long Island, with an additional 32 teachers and administrators as part-time participants. Teachers will receive training in the SCIS program and will concurrently utilize this information during the academic year in their classrooms. Dr. Esther Sparberg, Department of Chemistry.

STATE UNIVERSITY COLLEGE AT BROCKPORT, Brockport 14420; *Secondary School Mathematics* (Colorado Schools Computing Science Curriculum Development Project materials); summer: 5 weeks, July 9—August 10, 1973; academic year 1973-74: 6 meetings; 40 high school teachers from Rochester City School District and Monroe County School Districts. Participants will prepare to use the computer as a modeling device and instructional tool in teaching secondary school mathematics and will implement use of relevant applications from the life sciences and social sciences. Dr. Theron Rockhill, Department of Mathematics.

STATE UNIVERSITY OF NEW YORK AT STONY BROOK, Stony Brook 11790; *Junior High School Science* (Intermediate Science Curriculum Study materials); summer: 2 weeks, August 20—August 31, 1973; academic year 1973-74: 8 meetings; 35 teachers from junior high schools in seven Suffolk County School Districts. Teachers will receive training in the use of ISCS materials and will teach the program during the academic year. Professor Ted Bredderman, Department of Education.

NORTH CAROLINA

CAMPBELL COLLEGE, Buies Creek 27506; *Physical Science;* summer: 4 weeks, July 9—August 5, 1973; academic year 1973-74: 10 meetings; 30 secondary school science teachers from Harnett, Wake, Lee, Johnston, and Sampson counties and Sanford City School Systems. Teachers will receive training in providing laboratory experiences for the junior high or high school physical science curricula. A laboratory manual will be developed and teachers will implement the laboratory program during the academic year. Dr. Louis S. Hovis, Department of Physics.

NORTH DAKOTA

UNIVERSITY OF NORTH DAKOTA, Grand Forks 58201; *Elementary School Science* (Elementary Science Study materials); summer: 4 weeks, July 16—Ausust 10, 1973; academic year 1973-74: 14 meetings; 56 intermediate level elementary school teachers and 19 elementary school principals from Grand Forks Public Schools, Grand Forks Parochial Schools, East Grand Forks Public Schools, East Grand Forks Parochial Schools, Thompson Public Schools and Drayton Public Schools. Teachers and principals will receive instruction in ESS materials and be prepared to implement the program in their schools. Dr. Leonard Marks, Center for Teaching and Learning.

OHIO

BALDWIN-WALLACE COLLEGE, Berea 44017; *Mathematics* (Colorado Schools Computing Science Curriculum Development Project materials); summer: 3 weeks, August 6—August 24, 1973; academic year 1973-74: 10 meetings; 35 secondary teachers from metropolitan Cleveland school districts, including Avon Lake, Berea, Beaumont School for Girls, Brecksville, Brooklyn, Brush, Central Catholic, Lake Ridge Academy, Lakewood, Medina, Olmsted Falls, Parma Normandy, Parma Senior, Parma Valley Forge, Rocky River, St. Edwards, Shaker Heights, University School, and Westlake. Teachers will be trained in using the computer to teach the materials developed by the Colorado Schools Computing Science Curriculum Development Project. Dr. Timothy A. Riggle, Department of Mathematics.

MARIETTA COLLEGE, Marietta 45750; *Intermediate School Science* (Intermediate Science Curriculum Study materials); summer: 4 weeks, June 11—July 6, 1973; academic year 1973-74: 14 meetings; 44 intermediate school teachers, 12 administrators, and 18 students (for micro-teaching demonstrations) from twelve city and county school systems in southeastern Ohio and northeastern West Virginia. The main purpose of the program is to improve science instruction by implementing ISCS materials into the participants' schools. Dr. Jerry L. Montgomery, Department of Education.

MUSKINGUM COLLEGE, New Concord 43762; *Junior High School Physical Science* (Intermediate Science Curriculum Study materials); summer: 4 weeks, June 25—July 20, 1973; academic year 1973-74: 4 meetings; 16 elementary school science teachers and 8 supervisors and principals from eight city and county school systems in southeastern Ohio. Twenty 7th grade students will participate in micro-teaching sessions involving video-taping during the last two weeks of the summer session. The main purpose of the program is to improve science instruction in physical science through introducing ISCS materials into the junior high schools. Professor E. R. Gerlach, Chemistry Department.

OHIO STATE UNIVERSITY, Columbus 43210; *Elementary School Science* (Elementary Science Study materials); spring 1973: leadership training for 8 principals and 8 teachers; summer: 5 weeks, June 18—July 20, 1973; 56 elementary teachers from Worthington City and Grandview Heights City School Districts; academic year 1973-74: series of competency workshops, implementation of planned articulation, in-service training of remaining teachers by teachers trained in summer and operating in teaching team organization. Dr. Roger Cunningham, College of Education.

OHIO STATE UNIVERSITY, Columbus 43210; *Elementary School Science* (AAAS Science—A Process Approach materials); summer: 4 weeks, June 6—June 20 and August 15—August 23, 1973; academic year 1973-74: 8 meetings; 38 elementary school teachers, 7 principals, and intermediate grade pupils for demonstration and diagnostic teaching from the schools of Mansfield, Ashland, and Madison School Districts. Teachers will receive training in AAAS materials and computer simulated experiments, and will teach the program during the academic year in their classrooms. Dr. Barbara S. Thomson, Faculty of Science Education.

UNIVERSITY OF TOLEDO, Toledo 43606; *Junior High School Science* (Intermediate Science Curriculum Study materials); summer: 4 weeks, June 18—July 13, 1973; academic year 1973-74: 10 meetings; 30 junior high teachers from Lucas County, Maumee City, Monroe City, Sandusky County, and Bedford School Districts. The project is designed to provide the teachers with experiences in the effective use of the ISCS materials (with emphasis on Level III). Dr. J.L. Underfer, Environmental Science Institute.

OKLAHOMA

OKLAHOMA STATE UNIVERSITY, Stillwater, 74074; *Junior High School Science* (Intermediate Science Curriculum Study materials); summer: 5 weeks, June 4—July 6, 1973; academic year 1973-74: 18 meetings; 33 junior high school teachers and 7 junior high school principals from the Yale, Drumright and Tulsa School Districts. Teachers and principals will receive instruction in ISCS materials and techniques for implementation of this curriculum in their schools. Dr. Terence J. Mills, Department of Science Education.

See also Kansas: **KANSAS STATE COLLEGE**, in cooperation with Miami Public Schools, Oklahoma.

OREGON

PORTLAND STATE UNIVERSITY, Portland 97207; *Elementary School Science* (AAAS Science—A Process Approach, Elementary Science Study, Experiences in Science, and Science Curriculum Improvement Study materials); spring: 10 weeks, April 1—June 8, 1973; summer: 2 weeks, June 18—June 19, 1973; 60 teachers and administrators; academic year 1973-74: 6 meetings; 120 elementary school teachers and 8 administrators from the Beaverton, Corbett, Forest Grove, North Plains and Portland School Districts and the Catholic Archdiocese of Portland. Teachers, administrators and parents will receive instruction in one of these programs and be prepared to implement the curriculum in the schools. Dr. Michael A. Fiasca, School of Education.

UNIVERSITY OF OREGON, Eugene 97403; *Elementary School Social Science* (MAN: A Course of Study materials); summer: 4 weeks, July 16—August 10, 1973; academic year 1973-74: 10 meetings; 37 elementary school teachers and 11 administrators from schools of Eugene, Hillsboro, Newberg, North Clackamas, Reedsport, South Umpqua, and Winston-Dillard School Districts. School district personnel will receive training in MACOS materials and will teach the program during the academic year in their classrooms. Dr. William H. Harris, College of Education.

PENNSYLVANIA

CARLOW COLLEGE, Pittsburgh 15213; *Elementary School Science* (AAAS Science—A Process Approach materials); summer: 1 week, June 11—June 15, 1973; academic year 1973-74: 6 meetings; 60 elementary school teachers and 10 elementary school principals from Avonworth, Freedom Area, Quaker Valley, and Shaler Area School Districts. Teachers and principals will receive training in AAAS materials and be prepared to implement the curriculum in their respective schools. Dr. William A. Uricchio, Department of Biology.

CLARION STATE COLLEGE, Clarion 16214; *Elementary School Science* (Science Curriculum Improvement Study materials); summer: 3 weeks, August 6—August 24, 1973; academic year 1973-74: 63 classroom visits and consultations; 54 elementary school teachers and 12 science curriculum leaders from Allegheny-Clarion Valley, Brookville, Clarion, Clarion-Limestone, Immaculate Conception, Keystone, and Union School Districts. Teachers will be trained to use SCIS materials and teaching techniques, and will implement the program in their classrooms during the academic year. Dr. Kenneth R. Mechling, Biology Department.

DREXEL UNIVERSITY, Philadelphia 19104; *Secondary School Mathematics* (Secondary School Mathematics Curriculum Improvement Study materials); summer: 6 weeks, June 29—August 10, 1973; academic year 1973-74: 8 meetings; 50 junior high school teachers from the Philadelphia School District will receive training in SSMCIS materials and will teach these materials during the academic year 1973-74 in their classrooms. Professor John H. Staib, Department of Mathematics.

SLIPPERY ROCK STATE COLLEGE, Slippery Rock 16057; *Interdisciplinary Science* (Computer Applications in Natural and Social Sciences); summer: 6 weeks, June 25—August 3, 1973; or 3 weeks, June 11—29, 1973; academic year 1973-74: 3 meetings; 39 secondary school teachers (24 new to program, and 15 returning teachers), and 24 students (summer and academic year) and 1000 students (academic year only) from School Districts in Butler, Lawrence, and Mercer Counties. The application of computers in natural and social science and mathematics curricula will be investigated by teachers and selected students during the summer sessions with academic year implementation of computer exercises in the cooperating school systems. Dr. Monte W. Holland, Department of Physics.

TEMPLE UNIVERSITY, Philadelphia 19122; *Elementary School Mathematics and Science* (Minnesota Mathematics and Science Teaching Project materials); summer: 3 weeks, August 6—August 24, 1973; academic year 1973-74: 4 meetings; 24 elementary school teachers, 6 math-science supervisors, and 60 students (for demonstration classes) from Philadelphia Public Schools. Teachers will receive training in MINNEMAST materials and will teach the program during the academic year in their classrooms. Dr. David Fitzgerald, College of Education.

SOUTH CAROLINA

MORRIS COLLEGE, Sumter 29150; *Elementary School Mathematics* (Individualized Mathematics System materials); summer: 6 weeks, June 11—July 25, 1973; academic year 1973-74: 10 meetings; 30 elementary school teachers from Summerton School District No. 1. Teachers will receive instruction in mathematical topics and the use of IMS materials, and will prepare to implement the IMS curriculum in their schools. Professor James L. Solomon, Jr., Department of Mathematics.

TENNESSEE

EAST TENNESSEE STATE UNIVERSITY, Johnson City 37601; *Elementary School Science* (Elementary Science Study materials); summer: 1 week, June 11—15, 1973; academic year 1973-74: 5 group and 21 individual meetings; 21 elementary school teachers from schools of the Bristol City School System. Teachers will receive training in ESS materials and will use these materials during the academic year in their classrooms. Dr. William N. Pafford, Department of General Science and Science Education.

UNIVERSITY OF TENNESSEE AT CHATTANOOGA, Chattanooga 37401; *Elementary School Science* (AAAS Science—A Process Approach materials); summer: 3 weeks, June 18—July 7, 1973; 50 elementary school teachers; academic year 1973-74: 9 meetings; an additional 50 participants. Teachers from Chattanooga Public Schools and Hamilton County Schools will receive training in AAAS materials and will teach the program during the academic year in their classrooms and to their fellow teachers. Dr. Bernard W. Benson, Department of Education.

TEXAS

BISHOP COLLEGE, Dallas 75241; *Mathematics;* summer: 6 weeks, June 4—July 13, 1973; academic year 1973-74: 9 staff development sessions and 18 inservice meetings; 30 junior high school teachers from disadvantaged and inter-ethnic areas of the Dallas Independent School District. Teachers will develop mathematical curriculum materials such as modules and instruction kits, using audio and video tapes, and will implement an individualized mathematics program in their classrooms, making use of these materials and appropriate teaching strategies. Dr. Argelia Rodriquez, Department of Mathematics.

NORTH TEXAS STATE UNIVERSITY, Denton 76203; *Elementary School Science* (Science Curriculum Improvement Study materials); summer: 3 weeks, July 16—August 3, 1973; academic year 1973-74: 10 meetings; 30 elementary school teachers and 4 elementary school principals from the Irving Independent School District. Teachers and principals will receive instruction in the use of SCIS materials and in leadership training and will implement the program in their schools. Dr. Paul J. Cowan, Department of Education.

TEXAS SOUTHERN UNIVERSITY, Houston 77004; *Social Sciences* (Anthropology Curriculum Study Project and High School Geography Project materials); summer: 3 weeks, July 16—August 4, 1973; academic year 1973-74: 9 meetings; 16 teachers and 4 administrators from selected high schools within Houston Independent School District. Teachers will receive training in the anthropology and geography curriculums and adapt materials from these courses for implementation in the social science curriculum in their schools. Dr. J. B. Jones, Department of Psychology.

UNIVERSITY OF TEXAS AT EL PASO, El Paso 79968; *Elementary School Science* (AAAS Science—A Process Approach materials); summer: 6 weeks, June 1—July 15, 1973; 3 principals, 34 elementary school teachers, and 60 elementary students (for summer teaching) from the El Paso Public Schools and St. Clement's Episcopal Parish School; academic year 1973-74: 10 in-service meetings with 73 elementary school teachers and consultants. Teachers will receive training in the AAAS materials and be prepared to implement the program during the academic year in their classrooms. Dr. Max C. Bolen, Coordinator of Science Education for the School of Science.

UTAH

UNIVERSITY OF UTAH, Salt Lake City 84112; *High School Sociology* (Sociological Resources for the Social Studies materials); summer: 6 weeks, June 25—August 3, 1973; academic year 1973-74: 6 meetings, 5 workshops; 21 high school teachers, 3 administrators and 24 students (for demonstration classes) from the Granite School District. Participants will receive instruction in basic sociological concepts and recent innovations in the teaching of sociology at the secondary level (focusing on SRSS materials) and will be prepared to implement what they learn in their own schools as well as conduct workshops in others. Dr. Walter E. McPhie, School of Education.

VIRGINIA

MADISON COLLEGE, Harrisonburg 22801; *Mathematics for the Middle Grades;* summer: 3 weeks, June 13—July 3, 1973; academic year 1973-74: 26 meetings; 24 teachers (Grades 4-9) and one supervisor from Bath County and Highland County Public Schools, Virginia, and Pendleton County Schools, West Virginia. Participants will receive training in mathematics content and laboratory techniques, will develop a sequence of instructional materials, and will serve as specialists, demonstration teachers, and resource persons in their own schools. Dr. Charles R. Neatrour, School of Education.

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY, Blacksburg 24061; *Secondary School Multiple Sciences* (Biology, Chemistry, Physics, and Earth Sciences); summer: 4 weeks, July 23—August 17, 1973; academic year 1973-74: 20 meetings; 60 secondary science teachers and 6 secondary school administrators from Prince William County Schools. Teachers and administrators will receive instructions in the use of minicourses and be prepared to implement them in their schools. Dr. Thomas G. Teates, College of Education.

WASHINGTON

UNIVERSITY OF PUGET SOUND, Tacoma 98416; *Elementary School Science;* (Science Curriculum Improvement Study materials); summer: 3 weeks, June 13—July 3, 1973; academic year 1973-74: 18 meetings; 60 intermediate grade teachers, 5 principals and 90 students (for demonstration classes) from Northshore No. 417 and Mercer Island No. 400 School Districts. Participants will receive training in use of SCIS materials for the implementation of the program into their classrooms during the following school year. Professor Donald E. Acheson, School of Education.

WASHINGTON STATE UNIVERSITY, Pullman 99163; *Elementary School Science* (Science Curriculum Improvement Study and Elementary Science Study materials); summer: 3 weeks, June 12—June 30, 1973; academic year 1973-74: 6 meetings; 40 teachers and 5 administrators, from College Place, Kennewick, Richland, and Walla Walla School Districts. Participants will be prepared in the use of SCIS and ESS materials and will act as teachers and resource personnel in their respective school districts for total implementation of the selected elementary science programs. Professor Donald C. Orlich, Department of Education.

WESTERN WASHINGTON STATE COLLEGE, Bellingham 98225; *Elementary School Science* (Science Curriculum Improvement Study materials); summer: 4 weeks, June 18—July 13, 1973; academic year 1973-74: 16 meetings; 45 elementary school teachers and 3 elementary school principals from Sedro Woolley School District No. 101. Participants will receive instruction in use of the SCIS materials and will implement the program during the following school year. Dr. Lee Dallas, Department of Education.

See also Idaho: **UNIVERSITY OF IDAHO,** in cooperation with Eastern Washington School District No. 101: Spokane, Lincoln, Whitman, Stevenson, Ponderay, and Ferry.

WEST VIRGINIA

WEST VIRGINIA UNIVERSITY, Morgantown 26506; *Elementary School Mathematics* (National Council of Teachers of Mathematics materials); summer: 4 weeks, July 16—August 17, 1973; academic year 1973-74: 18 meetings; 25 elementary school teachers and 30 students (for laboratory classes) from Monongalia County Schools. The purpose of the project is to initiate and implement the activity oriented NCTM mathematics program in the elementary grades of Monongalia County Schools. Dr. Boyd Holtan, Department of Mathematics Education.

See also Ohio: **MARIETTA COLLEGE,** in cooperation with city and county school systems of northeastern West Virginia.

See also Virginia: **MADISON COLLEGE,** in cooperation with Pendleton County Schools, West Virginia.

WISCONSIN

UNIVERSITY OF WISCONSIN, OSHKOSH, Oshkosh 54901; *Elementary School Science* (Science Curriculum Improvement Study materials); winter 1973: 1 week; summer: 3 weeks (2 sessions), June 11—June 29 and July 2—July 20, 1973; academic year 1973-74: 12 meetings; 120 elementary school teachers and 9 elementary school principals from the Neenah Joint School District No. 1. Teachers and principals will receive instruction in SCIS materials in preparation for total implementation in all eleven Neenah elementary schools by fall of 1973. Dr. Ronald K. Gibbs, Secondary Education Department.

UNIVERSITY OF WISCONSIN, STEVENS POINT, Stevens Point 54481; *Elementary School Science* (Science Curriculum Improvement Study materials); summer: 4 weeks, June 18—July 13, 1973; academic year '973-74: 10 meetings; 40 elementary school teachers and administrators from the Merrill School District. Participants will receive instruction in SCIS materials and be prepared to implement the curriculum in their classrooms during the academic year. Dr. Roger L. Wood, Department of Elementary Education.

UNIVERSITY OF WISCONSIN, WHITEWATER, Whitewater 53190; *Elementary School Science* (AAAS Science—A Process Approach materials); spring 1973: Leadership Program for 15 weeks; summer: two 2-week sessions, June 18—July 29 and August 13—August 24, 1973; 90 teachers; academic year 1973-74: 4 monthly meetings for 115 participants (including 8 administrators) from Joint District No. 1, Waukesha Public Schools. Teachers and administrators will receive instruction in AAAS materials and leadership techniques in order to implement the curriculum in their schools. Dr. Ray Stonecipher, Department of Physics.